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ABSTRACT

A review was made of literature about individual differences in learning style. Four related topics were investigated: (1) learning style as the factor constituting individual differences among students; (2) the necessity of diagnosis to the learning style paradigm; (3) elements making up individual learning style differences; and (4) the relationship between academic achievement and matching instruction to students' learning styles. Three principal points stood out in the review of the literature. First, learning styles do exist. Second, learning styles are not difficult to identify and diagnose. Third, when students are taught through their preferred learning styles, academic achievement increases. (RH)

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THE DYNAMICS OF LEARNING STYLES AS A VIABLE TEACHING PARADIGM

BY

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INTRODUCTION

Improving the quality of education has been a primary concern to educators throughout its history. A reservoir of information is available which documents many changes and improvements. Major changes have taken place since the blab schools of pioneering America where children sat on puncheon benches and recited lessons aloud in unison resulting in a Babel. (Tunis: 57) Changes have taken place in the form of curriculum revisions, adoption of "new" methods of teaching, and a variety of patterns of school organization. However, none of these changes have improved academic achievement. (Cafferty: 104)

In a quest for the innovation that would increase academic achievement, the emphasis in schools has changed by decades since the turn of the century. In the 1930's, progressive educators concentrated on the needs of the child. In the 1940's, a nation at war developed a society-centered curriculum. In the 1950's and early 1960's, scholars focused on "subject discipline" orientation. By the late 1960's and early 1970's, the emphasis was on the total curriculum. So far in the 1980's, two major themes predominate: basic skills and educational accountability. (Keefe: 2) Because academic achievement has not increased, leaders from all sectors of our society have raised concern for our nation. Therefore in the early 1980's President Reagan appointed a task force to investigate the sorry plight of American education, and the results were that the Committee on Excellence in Education found that the United States was a nation at risk due to the mediocrity of

its educational system.

In the introduction of his book Individualizing Instruction, C. M. Charles cited a trend he deamed hopeful for education. The trend which he saw as gaining momentum was toward a model that claims statistical evidence for increased academic achievement: it is concerned with individualized learning styles. Charles stated that "it is not unlike individualized instruction fifteen to twenty years ago. It is persistent; it's growing. New success stories appear regularly. It will be a force to consider in the future." (ix)

James Keefe, director of research for the National Association of Secondary School Principals, blamed the failure of previous attempts at individualizing on a misunderstanding of how students learn. However, "the concept of learning styles revives the hope for an authentic individualized education since it starts with the learner and then proceeds logically to a consideration of the teaching and learning environment. An understanding of the way students learn is the door to educational improvement." (Keefe: 124)

Keefe also is a member of the board of directors of the Learning Styles Network, an organization established as a clearinghouse for research and development of learning styles established by staff at St. John's University. As an educator involved in and reviewing the research on learning styles, he claimed that learning styles is a major vector in teaching: "learning style diagnosis...gives the most powerful leverage yet available to educators to analyze, motivate, and

assist students in school... It is the foundation of a truly modern approach to education." (Dunn, 1984, b: 10) The argument of research documenting improved academic achievement invites investigation into the literature on the subject by the concerned and dedicated educator.

STATEMENT OF THE PROBLEM

When addressing the question of whether or not teaching through learning styles significantly increased academic achievement, Rita Dunn stated, "Educators have been reluctant to embrace innovations until data provide evidence that the new concept or process produces academic achievement at statistically significant high levels. Although waiting for such corroboration is reasonable, it often takes years to design, conduct, evaluate, and report on experimental studies." (c: 9) However, over the past decade a great deal of research has been conducted and documented on learning styles. Has enough information concerning the effectiveness of teaching students through their individual learning styles been compiled to make this a viable teaching model?

PURPOSE OF THE STUDY

The purpose of this study was to establish the existence of individual learning styles in students, identify the learning style paradigm, and investigate the results of its implementation in the in the school setting.

ORGANIZATION OF THE STUDY

The first section of this study dealt with the establishment of learning style as the factor constituting the individual differences among students.

The second section examined the necessity of diagnosis to the learning style paradigm.

The third topic presented the variety of elements which comprise individual learning style differences.

The last section studied the results of the research to discover if there is a significant relationship between academic achievement and matching instruction to students' learning styles. Within each section, annotations were arranged alphabetically by the author's last name.

DEFINITIONS OF TERMS

Abstract-random learner -- "is distinguishable by his attention to human behavior and an extraordinary ability to sense and interpret 'vibrations.'" "He associates the medium with the message evaluating a learning experience as a whole," He "prefers to receive information in an unstructured manner and is therefore comfortable in group discussions, activities which involve multisensory use, and busy environments. He seems to gather information and delay reaction. He then organizes material through reflection to get what he wants." (Gregorc and Ward: 22)

Abstract-sequential learner -- "is characterized by excellent decoding abilities in the areas of written, verbal, and image symbols... This type of learner prefers a presentation that has substance, is rational, and is sequential in nature... He is not deterred by a dull lecturer if the material presented is well-organized and meaningful. This preference also includes deference to authority in a learning situation and low tolerance for environmental distractions." (Gregorc and Ward: 22)

Analytic learners -- "prefer to be presented with, or to discover themselves each of the separate elements first (of a picture of situation), and then put them together in order to see the whole picture: work from parts to whole." (Brennan: 34) (see also discovery method, field independence, focuser, inductive learner, and left hemisphere)

Aptitude-Treatment-Interaction (ATI) -- "attempts to adapt instructional treatments to student characteristics." (McLeod and Adams: 118)

Cognitive mapping -- is the "technique used in determining a child's cognitive style." It "includes how a child uses symbols, the social and cultural determinants that affect him, and the method of the student's thinking." (Gartner and Riessman: 13)

Cognitive style -- is the "consistent individual differences in preferred ways of organizing and processing information and experience." (Mesoff: 7)

Concrete-random learner -- "is characterized by an experimental attitude and accompanying behavior. Such learners get the gist of ideas quickly and demonstrate the uncanny ability to make intuitive leaps in exploring unstructured problem-solving experiences. Occasionally, however, they also have also insights and make leaps in structured situations. They are then chided for not showing their steps or for jumping to conclusions... They utilize the trial-and-error approach when acquiring information." (Gregorc and Ward: 23)

Concrete-sequential learner -- "is characterized by a finely tuned ability to derive information through direct, hands-on experience. This learner exhibits extraordinary development of his five senses. Order and logical sequence... as well as touchable concrete material are appreciated. This learner prefers step-by-step directions... and will not tolerate distractions." (Gregorc and Ward: 22-23)

Deductive method -- "teaching from general principles, leading to particular examples and applications." (Page and Thomas: 90) (see also expository method, field dependence, global learner, right hemisphere, and scanner)

Disclosure -- "is explaining the results of the cognitive style map and giving information about strategies that a student could use in subsequent learning." (Fourier: 122)

Discovery method -- "refers to a teaching technique in which verbalization of each concept is delayed until the end of the instructional sequence in which the concept is to be taught." (Onyejiaku: 32) (see also analytic learners, field independence, focuser, inductive learner, and left hemisphere)

Electroboards -- are "effective instructional devices for tactually and visually oriented students." They are gamelike boards or boxes that teach and reinforce "information through an interesting approach." (Dunn and Dunn, 1978: 339)

Embedded Figures Test -- was developed by Witkin and is used to test the global-articulated dimensions of cognitive functioning. "The test has several possible simple figures embedded in more complex figures. Individuals who can distinguish with ease the simple figure 'hidden' are articulated (field independent). Those who have difficulty are global (field dependent). (Charlton: 244)

Expository method -- "refers to a teaching technique in which verbalization of the required concept is the initial step in the instructional sequence in which the concept is to be taught." (Onyejiaku: 32) (see also deductive learner, global learner, field dependence, right hemisphere, and scanner)

Field Dependence -- refers to persons who have global perceptual styles and tend to have greater social skills and oriented toward interpersonal relationships. Three characteristics of FD individuals are "(1) they tend to see a visual field as a whole, (2) they have difficulty in identifying the subcomponents of a visual field, and (3) they have difficulty imposing their own structure on an unstructure field." (Mesoff: 8) (also see deductive learner, expository method, global learner, right hemisphere, and scanner)

Field Independence -- refers to persons who have been analytic and tend to be task-oriented. Three characteristics of FI individuals are"(1) they are able to dis-embed hidden figures from a complex surrounding field, (2) they see items as discrete from their background, and (3) they are able to impose their own sense of structure on an unstructured perceptual field." (Mesoff: 8) (see also analytic learner, discovery method, focuser, inductive learner, and left hemisphere)

Focuser -- "a person identified along the Scanner-Focuser continuum who reads and listens for details, trying to learn facts and their meaning." (Copenhaver: 7) (see also analytic learner, discovery method, field independence, inductive learner, and left hemisphere.)

Gates-MacGinitie Reading Test for Speed and Accuracy -- "provides an objective measure of how rapidly students can read with understanding. (Gates and MacGinitie: 1)

Global learners -- "learn more effectively when having the whole picture or situation presented to them first and then discovering which elements are necessary to make up that picture: ...work from the whole to the parts." (Brennan: 34) (see also deductive learner, expository method, field dependence, right hemisphere, and scanner)

Hemisphericity -- is "the tendency for a person to rely more on one than on the other cerebral hemisphere in processing information." (Okabayashi and Torrance: 104)

Inductive learner -- "is the person who uses concept formation which abstracts and discriminates from particular objects or situations for form generalizations." (Page and Thomas: 173) (see also analytic learner, discovery method, field independence, focuser, and left hemisphere)

Intermediate students -- are "students in intermediate schools consisting of upper grades of an elementary school and the lower grades of a junior high school... grades six, seven, and eight." (Page and Thomas: 181)

Junior high students -- are "students ... in grades seven and eight and in many cases, nine... ages mainly 12 to 14 years." (Page and Thomas: 193)

Learning circle -- is a tactual teaching resource made of a tag board cut into a circle to review skill. (Dunn and Dunn, 1978: 321)

Learning style -- is the way in which an individual is "programmed to learn most effectively... to receive, understand, remember, and be able to use new information." (Reinert: 161)

Left hemisphere (left brain) -- "seems to be specialized for the logical, sequential processing of information and deals primarily with verbal, analytical, abstract, temporal, and digital materials." (Okabayashi and Torrance: 104)

Letteri Cognitive Profile -- "is a basic determinant of an individual's level of academic achievement and can accurately identify specific learning deficits significantly contributing to low academic achievement." (Letteri: 195)

Myers-Biggs Type Indicator -- is an instrument involving four dichotomous scales used to assess cognitive style based on Jung's theory in which much apparently random variation in behavior is actually orderly and consistent due to certain basic differences in the way people prefer to use preception and judgment. (Charlton: 245)

Primary students -- "students ...in grades one, two and three of an elementary school or grade school." (Page and Thomas: 272)

Proster Theory -- is a model which "holds that the brain, in effect, groups programs for related purposes into structures of 'prosters.' Prosters in turn are arranged in hierarchies, layer upon layer, giving the brain its incredible subtlety." (Hart, 1983: 395)

Reading Style Inventory -- is an instrument designed by Marie Carbo to diagnose students grades one to twelve. It "diagnoses individual reading styles and lists methods, materials, and strategies that are most and least recommended for each student based upon computer analysis." (Carbo, 1983, a: 59)

Right hemisphere (right brain) -- "seems to be specialized for processing information nonlinearly and holistically, simultaneously dealing with a variety of variables and different kinds of information. It seems to deal primarily with nonverbal, concrete, spatial, analogic, emotional, and aesthetic content." (Okabayashi and Torrance: 104)

Scanner -- is a "person identified along the Scanner-Focuser continuum who reads and listens for general or main points, trying to understand concepts, principles, and the general purpose." (Copenhaver: 7) (see also deductive learner, expository method, field dependence, global learner, right hemisphere)

Self-correcting task cards -- "are multisensory teaching resourses that respond to a youngster's need to see and to touch simultaneously." (Dunn and Dunn, 1978: 329)

Study of Children's Learning Styles (SCLS) -- is a scale developed by Paul A. McDermott and Barbara S. Beitman to "specifically designed for the study of learning styles smong preschool level children." (McDermott and Beitman: 7)

Your Style of Learning and Thinking (SOLAT) -- is an instrument used to obtain "left, right, and integrated hemisphere cognitive mode scores." (Stellern, et. al.: 103)

Walker Problem Behavior Identification Checklist (WPBIC) -- "is a screening device designed for elementary teachers to select children with behavior problems who need referal for psychological evaluation and treatment. The WPBIC consists of fifty observable statements of classroom behavior that might limit a child's adjustment in school." (Stellern, et. al.: 106)

Zenhausern's Hemispheric Activation Test (HAT) -- assesses Right and Left hemispheric abilities. "The mean difference between Right- and Left-directed items provides a measure of relative hemispheric preference - or activation." (Dunn, Cavanaugh, et. al.: 292-293)

ANNOTATIONS

ESTABLISHMENT OF LEARNING STYLE AS THE FACTOR CONSTITUTING THE INDIVIDUAL DIFFERENCES AMONG STUDENTS

Barger, Robert R., and Hoover, Randy L., "Psychological Type and the Matching of Cognitive Styles," Theory into Practice 23:56-63, Winter, 1984.

In this article the authors illuminated the role of Carl Jung's psychological type as an indicator of typical differences in teaching style and learning style by summing up eight major implications for understanding: (1) Differences in psychological type between teachers and students can lead teachers to misunderstand learning style of students. (2) Conflicts in type can lead to difficulties in communications between teachers and students and among students. (3) Type may affect students' preferences for instructional alternatives. (4) Type will affect teachers' preferences for instructional alternative. (5) There is a relationship between psychological type and subject matter: individuals of varying types tend to be interested in different subjects. (6) Identification of the function (student's learning style preference) related to the student's schooling problem can aid teachers in working with students having difficulties. (7) The first approach to students' learning problems should be through their strengths. (8) Improvement in schooling may mean dealing with an inferior function as well as strengthening the dominant auxiliary. The authors cited research findings suggesting descrepencies in psychological type among teachers and students do exist.

Birckbichler, Diane W., and Omaggio, Alice C., "Diagnosing and Responding to Individual Learner Needs," The Modern Language Journal 62:336-334, November, 1978.

Birckbichler and Omaggio addressed the importance of developing a curriculum that responds to the interests and needs of individual students in the foreign language program. In this article they presented an individualized approach to the study of foreign language that identified and labeled learning problems. The authors specified remedial activities which addressed the problems in speaking, listening, reading, writing, vocabulary acquisition, and grammar tasks. They offered these suggestions as one viable, practical way to respond to the needs and preferences of the individual learner.

Carbo, Marie, "Reading Styles Change Between Second and Eighth Grade," Educational Leadership 40:56-59, February, 1983.

This research report was based on the Reading Style Inventory (RSI) based on the Dunn and Dunn learning styles model given to 293 students in second, fourth, sixth, and eighth grades. The results indicated that children in the primary grades were teacher-motivated, preferred structure, movement and intake while reading, and wanted to learn to read with their teachers and peers using their tactual and kinesthetic senses. Students in the intermediate and junior high grades tended not to be teacher-motivated and needed less movement, intake, and structure, but more choices of reading materials. They significantly (.001 level) demonstrated greater visual and auditory strengths than primary grade youngsters and preferred to learn alone and/or peers. Most students preferred not to read in the morning and liked to read in an informally designed area with intake available. The differences in reading style among the primary, intermediate, and junior high school students strongly suggested that alternative approaches must be made available to youngsters at every level.

Charles, C. M., "Styles of Learning," in Individualizing Instruction, St. Louis: The C. V. Mosby Company (1980), 67-68.

Charles cited ten pairs of either-or labels that different investigators used to describe learning styles. A teacher directed effort to identify learning style differences and then match appropriate instructional strategies led to the following synthesized classifications of students types: (1) adventurers who are impulsive and do not seem overly concerned with doing things the "right" way or with giving the right answer, (2) ponderers who are more reflective and analytic and usually willing to work at tasks provided but are too anxious to begin nor finish and move on to something else, and (3) drifters who are characterized as more mechanical, dependent upon others, losing interest quickly, and are below average in creativity and achievement.

Dunn, Rita; DeBello, Thomas with Patricia Brennan; Krimsky, Jeff; and Murrain, Peggy, "Learning Style Researchers Define Differences Differently," Educational Leadership 38:372-375, February, 1981.

The authors delineated the various researchers' definitions of learning style, means of instrumentation, and focused on applications and implications of the instruments in the educational environment. Eight of the leading research teams or individual researchers were identified. Although widespread agreement supported existence of individual differences, learning style researchers tended to define the concept differently. However, a quote by James Keefe, director of research for the National Association of Secondary School Principals, centralized a common theme in the work on learning styles: "Learning style diagnosis opens the door to placing individualized instruction on a more rational basis. It gives the most powerful leverage yet available to educators to analyze, motivate, and assist students in school. As such, it is the foundation of a truly modern approach to education." (372)

Dunn, Rita, and Dunn, Kenneth, "Learning Style as a Criterion for Placement in Alternative Programs," Phi Delta Kappan 56:275-278, December, 1974.

The authors cautioned against prescribing innovative alternatives to traditional instruction on a wholesale, random, voluntary, or parent-determined basis. Before students can be grouped for instruction by matching how they learn with how the program will require them to learn, the authors stated it would be necessary to (1) identify and understand learning style, (2) identify the learning style requirements of selected programs, and (3) compare the student's learning style profile with the demands of the program. The article contained charts suggesting basic philosophy represented by selecting instructional programs and the related skills that were required of participating students. The skills were correlated with the learning style elements that the student should have to function effectively in the program.

Dunn, Rita; Dunn, Kenneth; and Price, Gary E., "Diagnosing Learning Styles: A Prescription for Avoiding Malpractice Suits," Phi Delta Kappan 58:418-420, January, 1977.

In this article the authors cited several court cases where school boards were sued because high school graduates who were "teachable" and of average intelligence did not achieve. The authors have designed an instrument useful as a diagnosis tool called the Learning Styles Inventory (LSI). It is based on research data that yields 18 categories that suggest that learners are affected by their immediate environment, emotionality, sociological needs, and physical needs. An experiment using the LSI demonstrated that teachers were able to recognize certain learning styles with considerable accuracy. Diagnosis of this type and prescriptions would verify that teachers have made every professional effort to assist students and could help avoid malpractice suits concluded the authors.

Dunn, Rita; Dunn, Kenneth; and Price, Gary E., Learning Styles: Research Vs. Opinion," Phi Delta Kappan 62:645-646, May, 1981

The authors defended the validity of their work in learning styles against a critical examination from Leonard Davidman. Their response was research verified to concerns about instrumentation. (1) Students are capable of accurately indicating the ways in which they will achieve best. (2) Increased academic achievement among students taught according to their individualized learning styles will be more likely to serve society better than those who continually experience frustration. (3) In reply to Davidman's recommendation that student needs should be determined by teachers, the authors countered that two studies indicated that teachers often cannot identify students' learning styles accurately by observation. (4) In response to Davidman's suggestions that the authors do not believe that students' learning styles change, they confirmed that they do believe they change and appear to parallel the growth curve. But, they pointed out that existing styles need to be treated with appropriate materials and methods; when they change, alter resources and strategies accordingly. (5) They challenged Davidman to read the Learning Style Inventory Manual more carefully.

Friedman, Peggy, and Alley, Robert, "Learning/Teaching Styles: Applying the Principles," Theory into Practice 23:77-81, Winter, 1984.

In this article the authors reduced the volumes of research and development on learning styles into six principles and illustrated a variety of ways learning styles theory has been utilized in education with five case studies. They also cited the research supporting each principle: (1) Both style by which the teacher prefers to teach and the style by which the student prefers to learn can be identified. (2) Teachers need to guard against over-teaching by their own preferred learning styles. (3) Teachers are most helpful when they assist students in identifying and learning through their own style preferences. (4) Students should have the opportunity to learn through their own preferred style. (5) Students should be encouraged to diversify their style preferences. Although 15 percent of elementary school age children are kinesthetically oriented in their learning style preferences, most schools continue to rely almost exclusively on audio or visual modalities as primary teaching styles. Researchers, Barbe and Milone (1980), were cited as asserting that children who learn comfortably through a mixture of three basic modalities have an advantage in school learning. (6) Teachers can develop specific learning activities which reinforce each modality or style.

Gartner, Alan, and Riessman, Frank, How to Individualize Learning, Phi Delta Kappa Educational Foundation, Bloomington, Indiana, 1977, 29pp.

The authors identified dichotomous individual differences in students' learning preferences: starting from the general or the specific, starting from the concrete or the abstract, working alone or in a group, learning from interchange with others or from books, learning quickly or slowly, learning more readily by reading or by hearing or by physical involvement, concentrating for long periods of time or needing a shift back and forth between subjects, needing a desk or needing to move around, needing absolute silence or noise. The authors warned educators about the children who do not seem to fit in. "Today, it seems, if a child does not learn something right off, we assume that the difficulty must arise from an emotional block or conflict, or a 'learning disability.' There may be a different way of looking at the problem. Children may not be learning because the instructional approach is not suited to their style, hence they cannot utilize their power effectively." (13)

Gregorc, Anthony F., "Styles as a Symptiom: A Phenomenological Perspective," Theory into Practice 23:51-55, Winter, 1984.

In this article Gregorc presented some findings from his past and ongoing studies which have yielded the proposition that stylistic characteristics are powerful indicators of deep underlying psychological forces that help guide a person's interactions with existential realities . The data from his 1974 study of 20 males and 20 females ages 13 to 65 who were "successful" learners drew three inferences: (1) Dispositions are both natural and learned; therefore style patterns can be learned or adopted to some degree. (2) Mind sets arise from the driving forces of space, time, mental processing, and relationships which are used for establishing existential reality. Although these qualities are universal, subjects revealed strong "tippings" toward one type of space, time, processing and relationship preference more than another. Having dual aspects of four driving forces, the mind is capable of dealing with multiple realities. (3) Despite similar driving force capability for establishing contact with existential realities most individuals are predisposed to relate most effectively to certain environmental situations which are in tune with the qualities and mind sets they possess. Later studies showed strong correlations among the four mind sets.

Reckinger, Nancy, "Choice as a Way to Quality Learning," Educational Leadership 36:255-256, January, 1979.

Reckinger cited statistical examples that verify why schools should provide alternative programs for the many students who do not learn in the conventional classroom. She quoted experts in the field of juvenile delinquency and rehabilitation who admonish that the educational system underscores auditory learners' failings to read because they are not visual learners and thereby render them failures. She stated: "When we respect the differences we know exist in people, and when we value the contributions to be gained by those differences, we shall widely and effectively provide for their nurture and cultivation, encouraging them to become all they can be." (256) She proposed that each student be permitted to achieve in his or her best style.

THE NECESSITY OF DIAGNOSIS

TO THE LEARNING STYLE PARADIGM

Abruzzese, Anthony A., "Effective Communications Through Educational Cognitive Style," Educational Resources Information Center, ED 182 744, October, 1979, 23 pp.

In this position document, Abruzzese referred to educational cognitive style as a person's preferred ways of gathering meaning from surroundings. He compared communication and educational cognitive style. It involved four groups of behaviors: receiving, expressing, reasoning, and handling the receiving/expressing in specific settings or modalities. Several ideas were common to both communication and educational cognitive style. By using the results of various cognitive style measurement instruments, teachers could discover how persons prefer to receive messages, the kinds of settings they prefer, the reasoning patterns they use to make decisions, and their preferred methods of expressing messages. When this information is assembled and analyzed, the communication process could be made more personal and thus more effective.

Bennett, Christine, "Individual Differences and How Teachers Perceive Them," The Social Studies 70:56-61, March/April, 1979.

The author reviewed case studies and research to demonstrate that all students learn better when taught through their learning strengths. It was concluded that all students have learning strengths and that educational systems should diagnose and teach through those strengths and if the task of adequately diagnosing the learning style of all students is impossible, then at the least educators need to start with those who are the obvious failures.

Cavanaugh, David P., "Meeting the Needs of Individuals Through Their Learning Styles," in Student Learning Styles, Diagnosing and Prescribing Programs, National Association of Secondary School Principals, Educational Resources Information Center, ED 182 859, 1979, 9 pp.

Cavanaugh outlined the diagnostic/prescriptive steps taken at Worthington High School in Worthington, Ohio, to meet their overall goal of providing an environment in which all students can learn and grow toward their greatest potential. They implemented a "two-pronged" approach to learning diagnosis by administering the Cognitive Style Mapping Inventory by Hill and the Learning Style Inventory by Dunn, Dunn, and Price. They began by researching the literature and inservicing their teaching staff. The principal conducted monthly inservice programs. Illustrated in the article were Methods Factor Coordination Sheets which they developed to match learning styles to instructional methods. Later they upgraded this technique by using the school computer to sort the matrix of methods and factors allowing them to print out not only the learning style factors but also a suggested prescription by subject for each student.

Cavanaugh, David P., "Student Learning Styles: A Diagnostic/Prescriptive Approach to Instruction." Phi Delta Kappan 63:202-203, November, 1981.

In this article Cavanaugh reported, as principal of Worthington High School, Worthington, Ohio, how he encouraged a learning styles diagnostic/prescriptive approach to instruction. He systematically trained teachers who volunteered to participate in the program. They met monthly for discussion and inservice, and he required them to meet certain obligations. Forty-two of 136 faculty members volunteered to take part; more have since joined the ranks. He reported increased academic achievement, improved attitudes toward school and reduced truancy as a result of teaching students through their unique learning characteristics.

Dunn, Kenneth, "Madison Prep: Alternative to Teenage Disaster," Educational Leadership 38:386-387, February, 1981.

The remarkable success of an alternative school in New York City which attributed its success to use of learning styles inventories was reported by the author. The teacher, Helen Hodges, took some of the "worst" students from Junior High School 22 and found a teaching area outside of the school building - a basement of a nearby apartment house. With a meager budget and $600 of her own, she and the students made their own self-created environment. The first educational task completed by the students was a diagnosis of each student's individual learning style. The students responded to a series of questions dealing with 18 aspects about environment, emotion, structure, and physical elements of how they learn best. Assignments were prescribed based on individual student characteristics. As a result students succeeded beyond expectations and helped each other to overcome negative or criminal behavior and stand together as a group giving them a greatly improved self-concept.

Dunn, Rita, "Learning Style: State of the Science," Theory into Practice 23:10-19, Winter, 1984.

In this article Dunn cited and summarized the research verifying the validity of learning styles diagnosis. She delineated two tables with the researcher, data, population and findings to document the positive answers to the two frequently asked questions: Can students identify their own learning styles and do gifted and talented students require unique instruction? She quoted Scott D. Thomson, executive director of the National Association of Secondary School Principals, when he stated in 1979 that "the ability to map learning styles is the most scientific way we know to individualize instruction." (10)

Fourier, Mary Jo, "Academic Achievement of Students Who Receive Disclosure of Cognitive Style Map Information," The Journal of Experimental Education 51:122-130, Spring, 1983.

Fourier investigated the hypothesis that disclosure of cognitive style map information raises the academic achievement of community college students. The subjects were 554 students enrolled in humanities, life science, and psychology. Experimental group subjects were administered a self-report inventory to obtain data to develop a cognitive style map, while control group subjects were administered the Study of Values inventory as a placebo disclosure treatment. Semester grades were obtained from instructors. Experimental and control group mean differences in all three areas were statistically significant at the .01 level. The size of the absolute difference in percentage points demonstrated a considerable effect on the semester grade. It was concluded that disclosure of cognitive style map information has an important beneficial effect on academic achievement. This research suggested that educators should consider becoming knowledgeable in the explanation and interpretation of elements of a cognitive style map plus planning disclosure time with students.

Keefe, James W., "School Applications of the Learning Style Concept," Educational Resources Information Center, ED 182 859, 1979, pp. 124-136.

After reviewing various authors' emphases on learning styles, Keefe clearly stated what he believed to be the future of learning styles based instruction: "Learning styles is much more than just another innovation. It is a fundamental tool with which to work. It is a basic framework upon which a theory and practice of instruction can be built." (134) "Learning styles diagnosis opens the door to placing individualized instruction on a more rational basis. It gives the most powerful leverage yet available to educators to analyze, motivate, and assist students in school. As such, it is the foundation of a truly modern approach to education." (135)

Letteri, Charles A., "Cognitive Profile: Basic Determinant of Academic Achievement," The Journal of Educational Research 73:195-198, March/April, 1980.

The results of this study indicated that a cognitive profile which is a combination of seven cognitive dimensions makes it possible to study the interrelationships between these seven dimensions and their combined impact on performance levels in a given learning task. The subjects were a group of 56 seventh and eighth graders matched for age and sex. The results indicated that the cognitive profile can separate seventh and eighth grade subjects into significantly (.05 level or better) different achievement level group as measured by standardized tests, account for as high as 87 percent of the variance in standardized test scores, and predict those scores at a level of .05 or better. Letteri believed that the cognitive profile is such a basic determinant of an individual's level of academic achievement and can accurately identify specific learning deficits significantly contributing to low academic achievement that teachers have an accurate statement concerning where the specific deficit is located and can direct their efforts in a more focused and efficient manner to help ameliorate learning deficits. He concluded that training of educators is necessary to acquire the strategies for teaching students of differing styles.

Marcus, Lee, "How Teachers View Student Learning Styles," National Association of Secondary School Principals Bulletin 61:113-114, April, 1977.

Marcus presented the findings of a survey taken to determine the extent to which teachers' perceptions of students' learning styles match their students' perceptions of the same. The subjects were 53 ninth grade students. A high percentage of accuracy on the part of teachers was found for some factors, but not on many others. There was disagreement when rating informal design and motivation factors. Students rated themselves as needing little structure and teachers disagreed 61 percent of the time. In all areas of perceptual modality except auditory there was a high percentage of disagreement and in the area on physical factors of intake during concentration periods and the need for mobility. In 70 percent of the cases teachers did not perceive students as being highly self- or adult-motivated when students did. This could be based on teachers' misconceptions of students' perceptual preferences. If teachers use lecture most of the time, they are not reaching visual, tactual, or kinesthetic youngsters. Lee concluded that errors in perception on the part of the teacher can lead to serious miscalculations and irreparable damage to students. Therefore, he suggested that for more effective learning to occur that administrators use inventories to determine student learning styles.

McDermott, Paul A., and Beitman, Barbara S., "Standardization of a Scale for the Study of Children's Learning Styles: Structure, Stability, and Criterion Validity," Psychology in the Schools 21:5-14, January, 1984.

The 16-item Study of Children's Learning Styles (SCLS) rating scale was completed by teachers from Pennsylvania and New Jersey for 1,513 kindergarten children and revealed three distinct styles of learning-related behavior: avoidant, inattentive, and overly independent. The results indicated that it is possible to design a reliable and valid preschool assessment device that is directed exclusively toward learning-related behavior and which does not rely upon estimates of general intellectual potential, academic readiness, personality, or perception - conventional approaches that do not tell the classroom teacher about how the child best learns and how the child is special in a variety of others ways directly related to successful schooling. With SCLS, measures of learning style can be gathered over relatively brief time periods for large groups of children, with each type of assessed behavior showing promise of improvement through established instructional programs.

Price, Gary, E.; Dunn, Rita; and Sanders, William, "Reading Achievement and Learning Style Characteristics," The Clearing House 54:223-226, January, 1981.

This study investigated how selected learning style characteristics can be used as predictors to identify early those students who are likely to become good readers. The subjects, 85 students (13 in grade three and 72 in grade six), were administered the New York State Pupil Evaluation Program (PEP) in Reading plus the Dunn, Dunn, and Price Learning Style Inventory. There were eleven Learning Style Inventory variables that significantly discriminated between subjects who had high and low reading achievement. Individuals with high reading achievement preferred studying in a dimly lit, formal environment; they were self- rather than adult-motivated; they were persistent and responsible; they did not require food intake while studying; they did not function best in late morning; they did require opportunities for mobility; and they did not prefer to learn through their tactile or kinesthetic senses. Since students who were low achievers in reading preferred learning through their tactile and kinesthetic senses, it was possible that if they had been, they might have become high reading achievers. The authors concluded by strongly recommending diagnosis of academic achievement and learning style and prescription on the basis of these two essentials.

Reinert, Harry, "One Picture Is Worth a Thousand Words: Not Necessarily!" The Modern Language Journal 60:160-167, April, 1977.

When the Edmonds Washington School District developed its individualized foreign language program, its staff members became interested in identifying the way in which individual students learn best. The investigation into individual learning styles indicated that no one approach would be equally effective for every student. They developed the Edmonds Learning Style Identification Exercise (ELSIE) which a teacher could administer, score, and roughly evaluate in less than a half-hour class time. It was discovered that all students were in one or a combination of four learning modes: visualization, written word, listening, or activity. The students' raw scores were graphed on individual profile sheets which were divided in bands like a stanine scale. The scores demonstrated that if the teachers "teach to the middle," they would miss most students. This study demonstrated that students should be taught in their most efficient learning style stated Reinert. He also concluded that differences between individuals are far more extensive and much deeper than frequently imagined.

Smith, Linda H., and Rensulli, Joseph S., "Learning Style Preferences: A Practical Approach for Classroom Teachers," Theory into Practice 23:44-49, Winter, 1984.

The authors examined the importance of considering learning style when planning educational programs. Based on a growing body of research which demonstrated that matching student to learning environments affects cognitive outcome, the authors designed a learning style inventory (LSI) consisting of 65 items which determines ways in which students prefer to pursue various types of educational experiences. The initial study established the LSI's validity and reliability and confirmed the fact that matching learning style to environment significantly enhanced educational outcomes. Other findings indicated that gifted students ranked last those instructional styles that rely on auditory modality. The gifted preferred instructional methods that emphasized independence while students in the general population preferred instructional methods with more stucture. The general conclusions were that learning style assessment can help teachers direct their attention to the strategies that are most effective with either individuals or small groups of students.

A VARIETY OF ELEMENTS

MAKE UP INDIVIDUAL LEARNING STYLE DIFFERENCES

Banville, Thomas, "Responsibility: Which of the Gray Matter Is to Answer?" Early Years 11:71+78-79.

The author discussed the connection between hemispheric dominance and responsible behavior. He revealed that left-brained children tend to accept the values of others and find it difficult to reverse decisions, while right-brained children tend to examine the values of others and then formulate their own values. Banville concluded that acquiring responsibility must involve both left and right hemispheres because responsible behavior requires the presence of an underlying set of values. The left-brain child should be encouraged and guided to make his own choice.

Block, Jeanne H., "The Difference Between Boys and Girls: How Gender Roles are Shaped," Principal 60:41-45, May, 1981.

The findings reported in this article were based on a twelve year longitudinal study of the ego and cognitive development of boys and girls aged three, four, five, seven, and eleven years old. The research noted that boys were reared in ways that encouraged curiosity, independence, and exploration of the environment - behaviors needed for the kind of experimentation that Piaget thought critical for developing operative cognitive structures. In contrast, girls were found to be socialized in an atmosphere that prevented them from actively experimenting with their environment, encountering descrepancies, and trying to find solutions where they were given fewer chances to discover, examine, and understand the physical world. The way children are reared has implications for the way they are taught: the kinds of sex-differentiated socialization patterns do a definite disservice to both boys and girls by predisposing them to a more limited repertoire of behaviors than they might otherwise be capable of handling concluded Block.

Bolocofsky, David N., "Motivational Effects of Classroom Competition as a Function of Field Dependence," Journal of Educational Research 73:213-217, March/April, 1980.

The purpose of this study was to investigate the relationship of field dependence (FD) to the motivational effects of a competitive environment on classroom performance. Tenth grade students classified according to field dependence were administered reading comprehension tasks under the conditions of competition and noncompetition. A significant interaction between field dependence and competitive motivation was found: field dependent subjects increased their performance significantly when competing, while field independent subjects exhibited only a slight and nonsignificant change. The author suggested an extrapolation fo these findings applied to special education since earlier studies have shown special education children to be field dependent. He suggested that competition could be used in special education classrooms to improve achievement. The findings were clear that a competitive environment may be significantly more beneficial for some students (field dependents) than others (field independents).

Brennan, Patricia, "Teaching Children Globally and Analytically," Early Years 12:34-35, January, 1982.

In this article Brennan explained the difference between the psychological element of global verses analytical learning. Global learners work from the whole to the parts. They learn to read better from a whole-word language experience. Most children up to the age of seven prefer to learn globally according to research. The analytic learner, on the other hand, learns from parts to whole. Their learning preference responds better to a phonics approach when learning to read. Therefore no one instructional method complements all students' learning styles. She recommended that many different teaching styles be implemented by teachers to respond to the diversity of learning styles among their students.

Della Valle, Joan, "An Experimental Investigation of the Relationship(s) Between Preference for Mobility and Word Recognition Scores of Seventh Grade Students to Provide Supervisory and Administrative Guidelines for the Organization of Effective Instructional Environments," Doctoral Dissertation, St. John's University (1984), reported in "Restricted Mobility Deters Secondary Students' Scores," Learning Styles Network Newsletter 5:1,5. Winter, 1984.

Della Valle reported that analysis of the relationships among the need to move while learning, the environment in which instruction occurs, and effect of both on word-pair recognition scores revealed that when students were placed into settings congruent with their diagnosed preference, achievement scores increased beyond the statistically significant .001 level. The results of the data verified that students with either preference performed equally as well when matched, corroborating that both mobility and passivity are strengths when they are responded to positively; no differences were evidenced between the scores of students in the two extremely different environments, substantiating that no single environment generates greater achievement; and significant differences were yielded when mismatching occurred.

DeYoung, Alan J., "Classroom Climate and Class Success: A Case Study at the University Level," The Journal of Educational Research 70:252-256, May/June, 1977.

This study sought to assess the actual and ideal social climate of an undergraduate education social science class. DeYoung referred to classroom climate as the elements in the classroom which motivates students to learn by making the course interesting and exciting as well as intellectually challenging. The study entailed two phases. For the first phase, data was collected through administration of a reliable and valid classroom environment test to 25 students in the "real" classroom to ascertain whether or not better congruence between real and "ideal" classroom climates help achieve course objectives. Students reported data on overall course appreciation, class functioning, class content, teacher quality, and topic relevance to professional goals. Information regarding real-ideal discrepancies on each of these dimensions in phase one by class members was used to restructure the course for students of class two, the second phase. The results clearly showed that changing the social climate was possible and that the change resulted in significantly greater appreciation of the course, class functions, and class content all at the .01 level plus attendance increased.

Douglass, Claudia B., "Making Biology Easier to Understand," The American Biology Teacher 41:277-281+298, May, 1979.

In this article Douglass described her efforts to develop a means to make biology easier to learn. Her subjects were 627 high school biology students half female and half male in six midwestern schools. Through the Group Embedded Figures Test she identified analytic (field independent) thinkers who function essentially inductively and global (field dependent) thinkers who function essentially deductively. She then designed both inductive and deductive resources to teach biology. The data evidenced from a pretest- posttest-control group design that when inductive students used inductive materials and when deductive students used deductive materials, achievement increased; where the students and resources were mismatched, less academic achievementment was realized. When a separate analysis of covariance was performed on only the very analytical and very global, the interaction of analytical ability and achievement was significant at the .01 level. These results indicated with 99 percent assurance that highly analytical students do better with inductive materials and highly global students do better with deductive materials.

Dunn, Rita S., "Learning - A Matter of Style," Educational Leadership 36:430-431, March, 1979.

Dunn focused on the "slow learner." The slow learners tend to be tactual and kinesthetic rather than being able to learn by reading or listening. They should be taught through self-correcting task cards, learning circles, electroboards, body games and multisensory instructional packages. If peer-orienced, they should be exposed to small-group techniques. The author reported that research has verified that slow learners do better when taught and tested in ways that respond to individual preferences.

Dunn, Rita; Cavanaugh, David P.; Eberle, Betty M.; and Zenhausern, Robert, "Hemispheric Preferences: The Newest Element of Learning Style," The American Biology Teacher 44:291-294, May, 1982.

To determine whether relationships actually exist between selected elements of learning style and hemispheric preference, this study was conducted to compare the identified learning style characteristics of 353 high school biology students grades nine through twelve and their Left/Right dispositions. Each youngster completed the Dunn, Dunn, and Price Learning Style Inventory and Zenhausern's Differential Hemispheric Activation Test. The results indicated that students who are not bothered by sound, prefer dim light, require an informal design, are unmotivated, are not persistent, prefer learning with peers, and prefer tactile stimulation scored significantly more Right preferenced than those whose learning styles did not include those elements. Right- and Left preferenced students have different environmental and organizational needs within the classroom as well as different motivational and personality characteristics. The results suggested that the differences between Right and Left preferenced students require different settings, and instructional approaches are necessary to provide complementary instruction. The null hypothesis was significantly rejected for hemispheric preference difference at the .01 level on six of eight subgroup scores and .05 level on two of eight eight subgroup scores.

Dunn, Rita, and Dunn, Kenneth, "Learning Style and Reading and Math Achievement," in Teaching Students Through Their Individual Learning Styles: A Practical Approach, Reston, Virginia: Reston Publishing Co., Inc., 1978, pp. 387-399.

Eighty-five subjects in grades three and six from three different schools in the New York City area took the Learning Style Inventory and the New York State's Pupil Program in reading and math. A discriminate analysis determined which of the Learning Style Inventory variables differentiated the subjects having high and low reading and math achievement scores. In reading there were eleven variables and in math there were eight that discriminated among the high and low achievement subjects. Persistence, functioning best in late morning, preference for an informal design and being responsible discriminated between high and low readers. Desire for a formal design, persistence, and functioning best in late morning discriminated the high from the low math achievers. The research on this sample indicated that by knowing how a person learns, one could predict correctly eight out of ten students who would do well and seven out ten who would have difficulty. It was hypothesized that individuals do not achieve well because of failure to meet their preferred methods of instruction.

Griggs, Shirley A., "Counseling the Gifted and Talented Based on Learning Styles," Exceptional Children 50:429-432, February, 1984.

This article reported the results of seven studies which implied that a pattern of core learning style preferences exists among gifted and talented students: Steward (1981), Dunn and Price (1980), Wasson (1980), Griggs and Price (1980), Kreitner, (1981), Cross (1982), and Price, Dunn, Dunn, and Griggs (1981). The results of each study demonstrated that the gifted and talented learners were independent learners, internally controlled, persistent, perceptually strong, nonconforming, and highly motivated. A broad range of techniques and strategies were recommended: focusing on highly cognitive processing, reasoning, abstract thinking, creative problem solving, and self-monitoring.

Hart, Leslie A., "The New 'Brain' Concept of Learning," Phi Delta Kappan 59:393-396, February, 1978.

The author stated that recent gains in brain research suggest that the schools are now largely brain-antagonistic. On the basis of neurological studies, all children cannot be expected to learn in traditional, structured classrooms. Each brain functions and absorbs information and skills as needed to make sense of what is presented, which would suggest that students accept only a portion of what instructors teach. He also stated that he believes the mind can comprehend more than is commonly suspected and maintained that mobility, peer and pair groupings and less structure are appropriate for many youngsters.

Hart, Leslie A., "Three Cheers for Smaller Failures?" Phi Delta Kappan 64:303-307, January, 1983.

Hart accused educators of having accepted only limited achievement among the majority and widespread failure among the minority because brain science is ignored. He submitted as an alternative his Proster Theory in which students capitalize on their personal interests to extract patterns that make sense to their worlds. He espoused a basic concept of having instruction fit the real nature of the brain, rather than trying to make the brain fit the school. In his theory he recognized individual differences and learning styles or strategies. He concluded: "As brain-antagonistic elements are eliminated from schooling and brain compatible facts are enhanced, the push-pull effect could conceivably bring about levels of student achievement that now seem incredible." (307)

Krimsky, Jeffrey S., "A Comparative Study of the Effects of Matching and Mismatching Fourth-Grade Students with Their Learning Style Preferences for the Environmental Reading and Accuracy Scores," Ed. D. Dissertation, St. John's University, 1982, University Microfilms International, 82-10415.

In this investigation performance in speed and accuracy was examined on the Gates-MacGinitie Reading Test for Reading Speed and Accuracy to determine the relationship, if any, between achievement and diagnosed learning preference determined by the Dunn, Dunn, and Price Learning Style Inventory for light when students tested in a classroom that was matched and mismatched with their individual preferences. The subjects were all fourth-graders in three elementary schools. Research data revealed that scores on both reading speed and accuracy were consistently significantly higher when illuminated environment was matched with each student's diagnosed learning style preference for the element of light. In addition, no significant difference was evidenced in reading speed and accuracy between students with a learning style preference for bright or dim light.

Levy, Jerre, "Research Synthesis on Right and Left Hemispheres: We Think with Both Sides of the Brain," Educational Leadership 40:66-71, January, 1983.

Based on scientific research and observation of split-brain patients, those who have incurred massive damage to one hemisphere, Levy documented that it is impossible for students to learn with only one side of the brain. She maintained that all subjects are learned with interhemispheric integration but suggested that the gateway into whole-brain learning may differ for different children, not that one hemisphere or the other should be the object of education. She concluded, however, that evidence does demonstrate that there are individual differences among people to the extent that one heimsphere is more differientially aroused than the other and a lesson presentation whether best introduced for a given child through left- or right-hemisphere processes is the initial step to the gateway of the brain.

Marcus, Lee, "Learning Style and Ability Grouping among Seventh Grade Students," The Clearing House 52: 77-380, April, 1979.

In this study Marcus compared three ability groups of seventh grade social studies students to determine whether differences in learning style preferences existed among them. Students were placed into "Above-Average," "Average," or "Below -Average" social studies on the basis of teacher observation, past achievement, I.Q. scores, and the result of reading comprehension tests. The Dunn, Dunn, and Price Learning Style Inventory was administered to each of the three ability groups to reveal what each student believed to be his/her learning style preferences. The data for this study indicated that differences do exist among the three groups in each of the four stimuli: environmental, sociological, emotional, and physical. Although tendencies for varying instructional strategies based on such differences, the author also cautioned that there was no unanimity on any one element of learning style and therefore it is still important to consider each student an individual.

Markman, Susan, "Hemispheric Cognitive Style and Processing Strategies in Verbal Learning," International Neuropsychology Society Convention, Mexico City (1982) in "Are Different Strategies Needed for Left/Right Brained Students?" Learning Styles Network Newsletter 3:1, Autumn, 1982.

The author reported on a study of 72 male and female fifth and sixth graders classified physiologically as either Right or Left Hemispheric styles. Half of each group were exposed to Left Hemispheric verbal and half to Right Hemispheric imagery instructional strategies, yielding a balanced match/mismatched design. The results were identical for speed, number correct, and number of errors. Rights who had been taught through the verbal strategy achieved significantly less well than the Lefts taught that way. Rights who had been taught through imagery achieved significantly better than the Rights taught "incorrectly," but Lefts taught through imagery revealed no differences from their Left counterparts. The results suggested that it is imperative that Right preferenced individuals be taught through visual imagery via print, pictures, filmstrips, transparencies, etc. Lefts, however, may be better able to adapt to less responsive strategies than Rights.

McLeod, Douglas B., and Adams, Verna M., "The Interaction of Field Independence with Small-Group Instruction in Mathematics," Journal of Experimental Education 48:118-124, Winter, 1979/1980.

McLeod and Adams tested the hypothesis that the cognitive style of field independence would interact with treatments that differed in the use of small groups as opposed to individual instruction. Subjects were 111 students from five sections of a mathematics class for prospective elementary school teachers. They were assessed for field independence and general ability and randomly assigned to either small groups or individualized study for one week of instruction. There was a significant interaction at the .05 level with measures of field independence when achievement was the dependent variable, but not when student ratings were used. It was difficult to distinguish between field independence and general ability, therefore the interaction appeared to be due more to general ability than to cognitive style. Students themselves gave significantly higher ratings to small-group instruction.

Odom, Richard D., McIntyre, Curtis W., and Neale, Gaile S., "The Influence of Cognitive Style on Perceptual Learning," Child Development 42:891-893, September, 1971.

This study compared the performance of impulsive and reflective learners. The subjects were 26 kindergartners of approximately equal number of boys and girls. The findings revealed that impulsive learners made more errors than reflective learners and that reflective learners needed fewer trials to learn. Implications derived were that significant improvement in the performance of impulsive children might be realized through training procedures that involve response postponement and/or attention to distinguishing features.

Okabayashi, Haruo, and Torrance, E. Paul, "Role of Style and Thinking and Self Directed Learning Readiness in the Achievement of Gifted Students," Journal of Learning Disabilities 17:104-107, February, 1984.

In this study 148 children, aged nine to 12, in three middle Georgia schools were investigated for failure to achieve at a level commensurate with measures of intelligence and other indicators of academic promise. It was hypothesized that failure to achieve was associated with preferred styles of processing information based on theory and research regarding the specialized cerebral functions of the left and right hemispheres. The highest achievers seemed to have developed skills in using an integrative style of processing information in either by using both the left and right hemispheres in conjunction or by shifting from one to the other as demanded by the nature of the task. The low achievement group reported a stronger preference for using right style of information processing. The findings suggested that the special programs in which subjects were participating emphasized achievements that called for integrative processing rather than left or right style.

Onyejiaku, Felix O., "Cognitive Styles, Instructional Strategies, and Academic Performance," Journal of Experimental Education, 51:31-36, Fall, 1982.

The author investigated the effects of two cognitive styles (analytic and nonanalytic) as well as two teaching methods (discovery and expository) on retention and transfer of math skills. The subjects were 40 boys and 40 girls ages 13 to 15 in two schools in Ibadan, Nigeria. The study concluded that a student's cognitive style influences his/her performance on mathematics tasks. Under expository instruction, analytic students scored significantly higher (at the .01 level) than the nonanalytic students. Under the discovery method, no significant differences were found. Also there were no consistent difference between discovery and expository methods of teaching in learning math tasks. Lastly, the interactions of student's cognitive style and teaching method depended on the sex of the student. There was more interaction for boys than for girls.

Peterson, Penelope L., and Janicki, Terence, "Individual Characteristics and Children's Learning in Large-Group and Small-Group Approaches. Report from the Project on Studies of Instructional Programming," Educational Resources Information Center, ED 176 884, Wisconsin University, Madison, Wisconsin, April, 1979.

In this study the researchers investigated aptitude treatment interactions (ATI) in fourth, fifth, and sixth grade students' learning in large and small group teaching approaches. Each of two elementary teachers taught a two week fractions unit to two classes of randomly assigned students. Each class received one approach. Students completed aptitude measures at the beginning of the study, and achievement, attitude, and retention measures at the end. Regression analysis showed significant ATI for preference, for approach, and for ability. High ability students performed better and had more positive attitudes in the small group approach, and low ability students performed better and had more positive attitudes in the large group approach. High ability students benefited by "teaching" their peers in the small group.

Pizzo, Jeanne S., "An Investigation of the Relationship Between Selected Acoustic Environments and Sound, and Element of Learning Style, As They Affect Sixth Grade Students' Reading Achievement and Attitudes," Ed. D. Dissertation Abstracts, St. John's University, 1981, Microfische 42:06, p. 2475-A.

Sixth grade students attending a middle school in Western Nassau County were diagnosed for their preferences for sound in the acoustic instructional environment. A significant interaction beyond the .01 level between the acoustic environment and individual learning style preference was found. The mean reading comprehension and attitude scores of sixth graders tested in an acoustic environment congruent with their diagnosed learning style preferences for sound were significantly higher than those of their peers tested in an incongruent acoustic environment. There was no significant interactions evidenced between acoustic environment and sex nor learning preference and sex. It was concluded that individuals (rather than males or females) do differ in their preferences for sound and learning style. Matching can significantly enhance educational outcomes.

Schmeck, Ronald R., and Lockhart, Dan, "Introverts and Extraverts Require Different Learning Environments," Educational Leadship 40:54-55, February, 1983.

Schmeck and Lockhart synthesized studies on the individual differences between introversion and extraversion and suggested that inherited differences in the ways in which people's nervous systems function require that some learn in a stimulating environment while others must have quiet, calm, and few distractions. They stated that introversion-extroversion is a continuum and not a dichotomy. Since students,then, would require both quiet and stimulating learning environments, there would be a challenge to create a solution. First, an environment that would be too stimulating for the teacher must be provided for most of the students. Second, a little extra stimulation must be provided for extraverted students. Finally, all this stimulation must be kept from interferring with the learning of extremely introverted children.

Shea, Thomas C., "An Investigation of the Relationship(s) Among Preferences for the Learning Style Element of Design, Selected Instructional Environments, and Reading Test Achievement of Ninth Grade Students to Improve Administrative Determinations Concerning Effective Educational Facilities," Ed. D. Dissertation, St. John's University (1983) reported in "Imposing Wrong Environments Lowers Secondary Test Scores," Learning Styles Network Newsletter 4:1, Winter, 1983.

In this study 32 boys and girls from 410 ninth graders in a New York junior high school revealed strong preferences when tested for their preferences for either a formal or an informal instructional environment when concentrating. They were equally assigned to either matched or mismatched designs. Data evidenced a significance interaction beyond the .001 level between learning style preference and the environmental design. Specifically, the mean reading comprehension scores of the students tested in an environment congruent with their preferences for an informal design were significantly higher than those of their peers tested in an incongruent setting. Interestingly, those who preferred a formal design, performed almost as well in an informal setting. However, research notes revealed those seated on the floor set their backs rigidly against the wall.

Stellern, John, Marlowe, Mike, and Cossairt, Ace, "Cognitive Mode and Classroom Behavior," Psychology in the Schools 21:103-111, January, 1984.

In this study the authors investigated the relationship between cognitive mode and classroom behavior. Randomly selected, 76 elementary students were tested to obtain their left, right, and integrated hemisphere cognitive mode score, and were also rated by their classroom teachers on a problem checklist and an informal teacher rating scale. Subjects determined to have a predominant right hemisphere cognitive mode scored significantly higher on the learning/behavior checklist and the problem checklist measures of acting out, withdrawal, distractibility, and total scale score than did subjects with a predominant left hemisphere dognitive mode or predominant integrated hemisphere cognitive mode. Researchers hypothesized that public schools emphasize left hemisphere instructional modality and discriminate against right hemisphere individuals causing them to act out and be distractible due to frustration.

White, Regina T., "An Investigation of the Relationship Between Selected Instructional Methods and Selected Elements of Emotional Learning Style Upon Student Achievement in Seventh Grade Social Studies," Ed. D. Dissertation Abstracts, St. John's University, 1982, Microfisch 42:03, 995-A.

White studied the relationship between learning style and instructional methods. The subjects were 80 of 161 middle class seventh grade pupils in a suburban junior high school - 40 of whom scored in the lower third and 40 of whom scored in the upper third of the sub-scales of persistence and responsibility of the Dunn, Dunn, and Price Learning Style Inventory (LSI). Each group of subjects was randomly and equally assigned to either a self-directed or teacher-directed class. A positive relationship was evidenced in the sub-scales of persistence and responsibility of of the LSI and achievement via conformance sub-scale of the California Psychological Inventory. The results demonstrated that persistent and responsible students scored significantly higher than students with low persistence and responsibility scores. High persistent and responsible students manifested conforming behavior while less persistent and less responsible students did not learn through conformity.

Zenhausern, Robert, and Dunn, Rita, "How Brainy Are You about the Brain?" Early Years 15:46-48, August/September, 1984.

The Center for the Study of Learning and Teaching Styles at St. John's University surveyed 2,000 teachers and administrators to see what they knew about the brain and how it affects learning. The authors included the ten item questionnaire and the results of each item. One item summary had specific classroom implications regarding the differences in learning style between left- and right-preferenced students: right-preferenced students are less bothered by sound when studying, prefer dim illumination, require an informal design, are less motivated in school, are less persistent, prefer learning with peers, prefer tactile to auditory or visual stimulation - even at the high school levels, and need mobility; left-preferenced students, on the other hand, are persistent and motivated toward school-related learning, consistently learn best in a formal design, prefer working alone rather than with peers, are teacher motivated, and do not need extensive mobility while engaged in concentration. Apparently, students who are right- and left-preferenced have different motivational and personality characteristics according to research stated the authors.

THE RELATIONSHIP BETWEEN ACADEMIC ACHIEVEMENT AND MATCHING INSTRUCTION TO STUDENTS' LEARNING STYLES

Cafferty, Elsie, "An Analysis of Student Performance Based Upon the Degree of Match Between the Educational Cognitive Style of the Teachers and the Educational Cognitive Style of the Students," Ed. D. Dissertation, University of Nebraska, 1980.

The learning styles of all teachers and all sophomores and juniors in a selected high school were identified and either matched or mismatched. Sixteen hundred and eighty-nine teacher-students pairs were confirmed. Students' styles matched their teachers'. The overall findings demonstrated that the greater the degree of congruence between the teachers' and students' styles, the higher the Grade Point Average. Conversely, the greater the dissonance between the two, the lower the Grade Point Average. This conclusion was based on an analysis of variance where nine out of thirteen null hypotheses were rejected at the .01 to .05 level.

Carbo, Marie, "Research in Learning Style and Reading: Implications for Instruction," Theory into Practice 23:72-76, Winter, 1984.

Carbo cited learning style diagnosis and prescription as one of the most promising solutions to raise reading achievement levels. She divided the research in reading and learning style into five categories and discussed the implications for each. The categories were environmental preferences, perceptual strengths/preferences, perceptual development, comparisons across grade levels, and comparisons across achievement levels. She concluded that learning style in reading indicated that student learning styles differed significantly across grade and achievement level, therefore, she stressed the importance for matching reading methods, materials, and teaching strategies to individual learning styles.

Carbo, Marie, "Research in Reading and Learning Style: Implications for Exceptional Children" Exceptional Children 49:486-494, April, 1983.

Carbo synthesized findings of nineteen studies which analyzed modality preference in reading. Research with the Dunn and Dunn model of learning style strongly supported the hypotheses that (1) reading achievement improves significantly when reading programs match individual learning styles, (2)poor readers tend to be tactile-kinesthetic learners with a biased arousal of the right hemisphere of the brain, and (3) the learning styles of many poor readers are not accommodated. One study (Kaley, 1977) indicated that learning style is a better predictor of reading achievement than IQ.

Charlton, Ronald E., "Cognitive Style Considerations for the Improvement of Biology Education," The American Biology Teacher, 42:244-247, April, 1980.

In this article the author described how he identified the learning styles of his biology students using the Myers-Biggs Type Indicator and created matching environments based on a review of the literature. This approach was not only successful with all students in his classes, but Charlton believed that it was especially important for the "non-science oriented" students. He included in the article a table of instructional activities to match each of four different cognitive styles.

Copenhaver, Ronnie W., "The Consistency of Student Learning Styles as Students Move from English to Mathematics," Ed. D. Dissertation, Indiana University, 1979.

The purpose of this research was to identify the learning style of tenth graders, and determine the consistency of their learning styles as they moved from their English class to their mathematics class over an eight week period. The research revealed that students' learning styles were consistent across subject areas, but were somewhat inconsistent across time. Negative implications were the results: students do not seem to recognize the need for using a particular learning style to attain success in a particular subject area, nor do they know when or how to change their preferred style of learning. Other research confirmed that one learning style was more successful than others in particular subjects areas; for example, Scanners (identified as being more globally oriented) were more successful than Focusers (identified as being more analytically oriented) in English, and Focusers were more successful in math. The author offered three possible remedies to the problem: (1) match students with teachers having the same learning styles, (2) teach students a variety of learning styles, and/or (3) teach teachers a variety of teaching styles. Copenhaver recommended a combination of the last two for more effective learning to occur.

Davidman, Leonard, "Learning Style: The Myth, the Panacea, the Wisdom," Phi Delta Kappan 62:641-645, May, 1981.

Davidman critically examined the work on learning styles of Hunt and Dunn, Dunn, and Price where he claimed their work in promoting the child's judgments of his or her own needs "undermines the greater vision of public education." He questioned students' capability of accurately identifying their own styles of learning. He claimed that the Dunns and Price do not recognize learning style change. He claimed the Learning Style Inventory Manual instead of aiding personalized education left a "false sense of knowing." He applauded the Hunt model insofar as Hunt believed it was possible to work with learning styles as a new concept while at the same time still adhering to the older planning tradition that relies on student needs as determined by teachers' opinions. He further outlined a personalized qualitative approach to learning styles based education that seemed, however, to incorporate the theories of Dunns/Price and Hunt as well as the "Diagnostic Teaching" approach of Madeline Hunter.

Deci, Edward L.; Sheinman, Louise; Wheeler, Lynne; and Hart, Robert, "Rewards, Motivation and Self-Esteem," The Educational Forum 44:429-433, May, 1980.

In this study teachers' styles for utilizing rewards and control were measured through a specifically designed questionnaire which characterized four different styles ranging from"very controlling" to "very informal." The subjects were 35 classrooms at the fourth, fifth, and sixth grade levels. The students' characteristics were assessed with an intrinsic motivation questionnaire of self-esteem. The results demonstrated a very strong correlation between a teacher's style and the intrinsic motivation and self-esteem of the child; the more controlling the teacher, the weaker the child's intrinsic motivation and self-esteem.

Doyle, Walter, and Rutherford, Barry, "Classroom Research on Matching Learning and Teaching Styles," Theory into Practice 23:20-25, Winter, 1984.

In a critical analysis of learning styles the authors made five points. (1) Diagnosis is necessary in order for the paradign to work, and the teacher has not likely been trained to use these instruments. (2) Where does a teacher stop in the pursuit of matching so many possible diverse combinations? (3) There would be a problem divising alternate instructional situations to accommodate the variations in learning style that could exist in one classroom. (4) The teacher must create a management system for administering a large quantity of records and papers. (5) The authors cited several reviews done on the literature on attribute treatment interactions which found few consistent results for programs matching instructional treatments to learning styles. In conclusion the authors stated that learning style is an important and significant dimension of individualizing but should not be the sole basis for designing instruction. They claimed that more classroom research must be done.

Dunn, Rita, "How Should Students Do Their Homework?" Early Years 15:43-45, December, 1984.

In this article Dunn admonished educators that it is unscientific and not in the students' best interest for achievement to direct youngsters toward specific homework practices without an appropriate research base and knowledge of each student's learning style strengths and weaknesses. Based on the research on two learning style characteristics, she outlined a nine-step, six-week experiment of instructional method-homework strategy for teachers to try to get better grades from their students. The instructional methods first considered each student's perceptual strength and second their preferred time of day. The concept to be learned would be presented first in the student's perceptual strength, reinforced through his/her secondary strength next and tertiary strength last. Homework would be done through the student's own perceptual strength and at his/her best time of day. Children achieved statistically higher scores (.001) when taught at times that complemented their learning preferences.(Virostko, 1983)

Dunn, Kenneth; Dunn, Rita; and Freeley, Mary Ellen, "Tips to Improve Your Inservice Training: Know Your Learning Style," Early Years 15:30-31, April, 1985.

The results of research conducted on the learning style element of Time of Day was reported in this article. The study was to determine whether teachers' attitudes changed, and if they were more likely or less likely to use what they were taught during workshops if their Time of Day preferences were matched or mismatched with inservice sessions. Time of Day preferences were identified with Productivity Environmental Preference Survey which is the adult version of Learning Style Inventory. The results showed that teachers used the instructional technique they had learned significantly more often when their inservice time was matched with their Time of Day preference. Additional results to the study showed morning preferents seemed to learn better through the lecture approach than through the experiencing (kinesthetic) one, and conversely, afternoon preferents learned more and implemented the techniques more often when they were taught by being required to participate than merely listen.

Emmer, Edmund T.; Oakland, Thomas D.; and Good, Thomas L., "Do Pupils Affect Teachers' Styles of Instruction?" Educational Leadership Research Supplement 31:700-704, May, 1974.

The authors presented the results of two studies which suggested that pupil participation (feedback) in a teacher's lesson affects subsequent preference for using the teaching styles of discovery versus expository. Both studies involved undergraduate educational psychology students as teachers and the shift was toward expository teaching due to feedback from students. The teachers felt they had better understanding of an expository style than a discovery style. The results suggested that the teachers' teaching style was affected by pupil participation.

Fischer, Barbara B., and Fischer, Louis, "Styles in Teaching and Learning," Educational Leadership 36:245-254, January, 1979.

The authors defined learning styles as a pervasive quality in behavior that persists though content may change. They defined and gave examples of ten learning styles and six different teaching styles. In conclusion they focused on the importance of matching teaching with students' learning styles. "Different instructional problems arise and different outcomes are achieved depending on the combinations (of learning and teaching styles) found in various classrooms." (251)

Fiske, Edward B., "Teachers Adjust Schooling to Fit Student' Individuality," The New York Times 131:C1,4, December 19, 1981.

Fiske, Education Editor of The New York Times, described his visit to a New York City school that had been responding to students' learning styles for the previous nine years. With a multi-ethnic student population that experiences a turnover rate of 50 percent every year, Public School 220 Queens reported significant gains in reading scores and other traditional measures of academic performance. The article concluded with a statement regarding the matching of teaching styles with learning styles: "While it is a practical impossibility to match teachers with students in terms of learning styles, it is important for teachers to recognize their own natural methods of learning and teaching and to incorporate that knowledge in lesson planning for each child."

Gregorc, Anthony F., and Ward, Helen B., "A New Definition for Individual." National Association of Secondary Schools Principals Bulletin 61:20-25, February, 1977.

The lack of identification between learning and teaching led Gregorc and Ward to conduct research through observations and interviews with hundreds of adolescents and adults to find dualities, observe how they manifest themselves, seek ways of addressing them when teaching, and develop strategies for encouraging balance within each student. Four distinct learning preference modes were identified: (1) abstract sequential (AS), (2) abstract random (AR), (3) concrete sequential (CS), and (4) concrete random (CR). If the instructional approach fit the preferred learning mode, the learner usually reacted favorably. If there was a mismatch, the student "worked hard to learn," "learned some and missed some material," or "tuned out." It was recommemded that teachers endeavor to match learning preferences of a broad spectrum of the students by observing behavior of learners and attempting an impirical assessment of learning preferences by using CS, CR, AS, and AR descriptions and attempting an instructional method that meets the broad range of the learners' preferences by giving several alternatives through which students may accomplish a course objective.

Heikkinen, Michael; Pettigrew, Frank; and Zakrajsek, Dorothy, "Learning Styles vs. Teaching Styles - Studying the Relationship," National Association of Secondary School Principals Bulletin 69:80-85, February, 1985.

This study researched the learning styles among education majors to learn if one's learning style preference influenced one's teaching style. The sample was 149 volunteer students enrolled in a junior level education methods course at the University of Idaho. The results demonstrated that each group of specific subject matter majors had strong preferences for some of the 16 learning variables. There were also significant learning style differences between elementary and secondary education majors, along with significant learning style differences between male and female education majors. The results of this study called attention to the need for a broader understanding of individual learning styles. The authors emphasized the importance of pluralistic approach to teaching if maximizing the learning process is to be the major goal of teacher education.

Hunt, David E., and Gow, Jane, "How to Be Your Own Best Theorist II," Theory into Practice 23:64-71, Winter, 1984.

Hunt and Gow presented a series of exercises to help increase teachers' self-knowledge and awareness of their students' learning styles. Rather then beginning with diagnosing students' learning styles, the authors advocated beginning with the teachers' own learning styles based on the following rationale: (1) awareness of one's own learning style is necessary before one can identify and understand the learning style of one's students, especially those students with learning styles differing from one's own, (2) one's own learning is closely related to one's preferred teaching style, and (3) learning style ideas are useful only insofar as they can be translated into matching statements, i.e.:"If this learning style, then this approach."

Hyman, Ronald, and Rosoff, Barbara, "Matching Learning and Teaching Styles: The Jug and What's in it," Theory into Practice 23:35-43, Winter, 1984.

In a critical analysis of learning styles based education the authors cited three major issues that present difficulties: (1) the focus on learning styles in determining teaching action is not appropriate theoretically or realistically because the authors claim, it does not consider subject matter, (2) the concept of learning style is not clear even among its advocates, and (3) finally, the action strategies of the learning style paradigm result in the unintended consequences from the students of lack of trust, low freedom of choice, manipulation and dependency. The authors concluded by making six recommendations encompassing a bilateral transition model where the teacher shares leadership, encourages the student to speak out, and feels successful when the students express themselves as individuals. Students help diagnose their own learning styles and help in determining the appropriate teaching strategy.

Kuchinskas, Gloria, "Whose Cognitive Style Makes the Difference?" Educational Leadership 36:269-271, January, 1979.

To determine the effect of cognitive style on the activities in the classroom, Kuchinskas observed students, teachers, and reading materials in 13 third- and fourth-grade classrooms. She interviewed teachers and students, performing formal and informal tests, observed instruction, and studied records and student work. She used a cognitive map to determine styles of the teachers, students, and cognitive style elements needed to use the instructional materials in the classroom effectively. A pattern emerged: the teacher's cognitive style determined how students would learn. The author stated that this is inconsistent with how research shows that children learn. She reported that when the teacher's cognitive style did not complement the child's, learning was less likely to occur. Matches of cognitive style and complementary methods caused increased achievement, whereas the mismatches resulted in the reverse. She concluded that the answer to the question "Whose cognitive style makes a difference?" is the teacher's. If the teacher is the key to student achievement and progress, the effects of his/her cognitive style on classroom activities need to be explored further.

Reynolds, Cecil, and Torrance, E. Paul, "Perceived Changes in Styles of Learning and Thinking (Hemisphericity) Through Direct and Indirect Training," The Journal of Creative Behavior 12:247-251, 1978.

The purpose of this study was to attempt to determine whether modifications in preferred modes of thinking and learning (hemisphericity) were possible with relatively short-term(six to twelve weeks) but intense training programs, employing either direct training in a specific style (right) or indirect training through exposure to a variety of styles and experiences. The indirect training group was composed of 200 gifted and talented high school students of the Georgia Governor's Honors Program. For direct training in right hemisphere functioning 68 graduate students from a variety of disciplines enrolled in a creative thinking course were selected as the second sample group. The results were significant to the .001 level that it is possible to modify an individual's preferred style of learning and control it in a general direction. Training in a specific style produced a shift in hemisphericity toward the hemisphere most closely associated with that style. Exposure to a variety of styles and experiences produced a more integrated style promoting cerebral complementarity (interhemispheric cooperation).

Saracho, Olivia N., "Relationship Between Cognitive Style and Teachers' Perceptions of Young Children's Academic Competence," The Journal of Experimental Education 51:184-189, Summer, 1983.

This study investigated the significance of matching and mismatching the cognitive style of field independence and field dependence between teachers and students. The subjects were 20 first- and 20 third-grade female teachers and a sample (480) of six boys and six girls for each teacher. Cognitive style was assessed, academic achievement was measured, other demographics were determined by means of a teachers' questionnaire, and the teacher completed a students' ranking form. A repeated measure analysis of variance indicated there was statistically significant (.05) interaction among the matched versus mismatched groups, sex and cognitive styles of teachers. The author concluded that educators encounter a complex system of relationships when attempting to improve students' educational performance through cognitive style matching.

Shade, Barbara J., "Cognitive Strategies as Determinants of School Achievement," Psychology in the School 20:488-493, October, 1983.

Shade tested the hypothesis that students who develop the school-preferred information-processing approach will perform better than other students. She used six instruments to identify preferred cognitive strategies in 135 ninth grade students from Racine and Kenosha, Wisconsin school districts. The results determined that the achievers were field-independent in cognitive style and the low achievers were field-dependent. In an analysis of variance using three achievement levels (high, medium, and low) for each instrument, there was a significant relationship between high achievers and the cognitive style of field independence of .001 in four of the six tests, .01 in one of the six, and no significance in the last test. The study indicated that there was school-oriented learning style which, when mastered by students, would very likely be beneficial to their school achievement, whether measured by grades or by achievement tests. Shade considered the results tragic since other research suggested that catering to other styles also can produce students who perform competently. She concluded that teachers should consider a multitude of teaching strategies complementary to a variety of learning styles so that all students have an equal opportunity to learn.

Tannenbaum, Rhonda, "Information-Processing Styles Create Achievement Levels." Learning Styles Network Newsletter 3:3, Winter, 1982.

Tannenbaum reported the results of her study investigating whether achievement levels were affected by methods through which students were taught. A group of 100 tenth, eleventh, and twelfth graders were categorized as either field dependent or field independent. They were assigned randomly to two different treatments of a lesson: a deductive sequence with convergent questioning complementing field dependent students, while an inductive sequence utilizing divergent questioning complemented field independent students. Adjusted posttest scores demonstrated an interaction effect at the .045 level of significance, indicating the field independent students who were provided the deductive sequencing structure and the field dependents who were provided the inductive sequencing structure performed statistically significantly better when taught through complementary methods.

Witkin, Herman A.; Moore, Carol Ann; Oltman, Philip K.; Goodenough, Donald R.; and Friedman, Florence, "Role of the Field Dependent and Field Independent Cognitive Styles in Academic Evolution: A Longitudinal Study," Journal of Educational Psychology 69:197-211, June, 1977.

This study sought to answer three questions: (1) Are students' cognitive styles related to their chosen major fields in ways predicted from the cognitive and personal characteristics involved in field dependence and field independence styles? (2) Are students' initial major choices at college entry likely to remain more stable over time if these initial choices are congruent with their cognitive styles than if not? (3) Are students' cognitive styles differently related to achievement in various major domains in ways expected from the nature of particular cognitive styles and the requirements of particular major domains? Students (N=1422) were followed through their college careers to a point at which they received a degree or dropped out. The results of this longitudinal study showed that cognitive style made a significant (.05 to .01) contribution to choice of educational vocational specialty.

SUMMARY

Three principal points stood out in the review of the literature. First, learning styles do exist. Secondly, learning styles are not difficult to identify and diagnose. Thirdly, when students are taught through their preferred learning styles, academic achievement increases.

One segment of the population which has recognized individual differences in people's styles of learning and continues to plead for schools to accommodate those differences are law enforcement agencies. Seventy to eighty percent of the youths in juvenile detention facilities are auditory learners, according to Thomas Taglianetti, director to California Youth Home. "What we do with these kids is to underscore their failings (to read) and by that convert them into failures. American schools take the attitude that failing a lot makes you a failure," Taglianetti was quoted as saying. (Reckinger:225) Approximately sixty-two percent of our student population does not function well in the traditional school partly because they do not have traditional learning styles and personalities. (225)

Parents are another segment of society who have recognized that their children have individual differences and are prosecuting school systems for allowing their illiterate children to graduate. In a New York decision, a school district's failure to teach a "teachable" child resulted in an award of private school tuition. (Dunn, Dunn, and Price, 1977: 418) In New Jersey, Thomas McNeil, a 20 year-old man with dyslexia, sued the school system, its physicians, psychologists, and other non-

school doctors for unspecified damages because of the loss of his earning capacity. Despite a second-grade reading level, McNeil was continually promoted and granted a high school diploma. His contention was that the defendents should have been able to diagnose his reading problem and treat it. (418)

In 1975 Congress also recognized individual differences in people and legislated that schools do more than recognize those individual differences when it mandated Public Law 94-142 which required that every handicapped child receive, at public expense, an education specifically designed to meet his unique educational needs. (Hasazi, et. al.: 6) Dunn not only warned educators that diagnosing learning styles is a prescription for avoiding malpractice suits, but if educators did not establish such a criteria that legislators soon would. Researchers, especially in the past decade, have recognized a direct relationship between academic achievement and learning style preferences. Although authors have used different terminology to describe learning styles, there was total agreement that students learn in different ways. (Dunn, DeBello, et. al.: 372)

Not only did the researchers agree that learning styles exist, but the research focused on the paramount importance of student diagnosis to determine the preferred learning styles of each individual student. Some teachers have countered by saying that they teach to the "average" student: therefore, they are bound to reach most of the students in their classrooms. Just as the Apostle John admonished the

Church about the sin of standing in the middle ground, Reinert cautioned educators that if teachers "teach to the middle," they would miss just about everyone in the class: differences between individuals are far more extensive and much deeper than frequently imagined. (168)

Teachers who are convinced that the learning style paradigm is effective and desire to accommodate their students' individuality have asked how they can determine the specific learning style of their students. The preponderance of researchers in this review of the literature agreed that diagnosis is an easy task consuming very little time. A number of instruments in this review of the literature are available and several researchers have designed and offered their own instruments. However, consumers must determine specifically what they desire to diagnose. The researchers agreed that learning styles refers to how a person learns, but the researchers often tested different dimensions in their diagnostic instruments. The Edmonds Learning Style Identification Exercise (ELSIE) designed by the staff in the Edmonds, Washington, school system when developing an individualized foreign language program would give the consumer an individual student profile on the four sensory learning modes of visualization, listening, written word, and activity. ELSIE has been made available free of charge for the asking. (Reinert) If the consumer is interested in an instrument to diagnose students' preferences for instructional methods only, the Rensulli-Smith Learning Style Inventory would fit their needs. (Smith and Rensulli) Anthony Gregorc has designed an in-

strument to diagnose "mind" qualities in the cognitive mode suggesting the dualities people employ when learning: concrete-sequential, concrete-random, abstract-sequential, and abstract-random. (Gregorc and Ward) The Dunn, Dunn, and Price Learning Style Inventory (LSI) is the most all-encompassing and was the most often used in the studies in this review of the literature identifying twenty-three elements within five stimuli of learning style preferences. See Appendix A. (Dunn, 1984, b: 11) This self-report instrument can be administered to students grade three to twelve. It also has an adult version entitled Productivity Environmental Preference Survey. Whichever diagnostic instrument is used, Dunn admonished the consumer to examine it for reliability and validity, or the data it yields could be inaccurate and potentially harmful. (12)

Besides diagnosis, Fourier went one step further: her study indicated that disclosure of cognitive style map information to the students themselves also had an important beneficial effect on academic achievement. She advocated that educators become knowledgeable in explanation and interpretation of the elements of a cognitive style map, as well as planning their schedule to include the necessary time to provide students with disclosure.

Rather then design instruction to be consonant with learning styles, four of the studies suggested, as an alternative, a rationale not mentioned in the other articles: change the learning style. Copenhaver stated that one learning style was more successful than others

in a particular subject area. He recommended that teachers in mathematics help Scanners to learn more analytically and the English teachers help Focusers to learn more globally. Okabayashi and Torrance hypothesized, that since teaching procedures most commonly emphasized the specialized function of the left hemisphere, perhaps low achieving students in gifted programs were characterized by high right hemisphere ways of processing information using both the specialized cerebral functions of the left hemisphere and right hemisphere in conjunction with one another. Although they did not specify how, the authors suggested that teachers of the gifted students in this study might improve student achievement by helping many of the low achievers among the gifted learn how to use both left and right hemisphere ways of processing information in conjunction with each other. As an aside to the conclusion of their study, Gregorc and Ward also recommended without specifying the means that teachers help students broaden themselves in areas of non-preference. (25) Finally, Reynolds and Torrance addressed the issue directly. They tested two groups of subjects, and they believed they proved that it was not only possible to modify an individual's preferred style of learning and thinking over a relatively brief time period (six to twelve weeks), but that they could control the general direction of the change.

High achievers seemed to share common learning style traits: they preferred a formal design (Dunn and Dunn, 1978) (Price, Dunn, Sanders); they were persistent and responsible (Dunn and Dunn, 1978)

(Griggs) (Price, Dunn, and Sanders) (White); they did not function best in late morning (Dunn and Dunn, 1978) (Price, Dunn, and Sanders); they were independent learners who were internally controlled (Griggs) (Price, Dunn, and Sanders); they were perceptually strong (Griggs) (Okabayashi), not preferring tactile or kinesthetic instruction (Price, Dunn, and Sanders), and more field independent in cognitive style (White); they preferred small group to large group instruction (Peterson); and they did not need intake when concentrating but preferred some amount of mobility (Price, Dunn, and Sanders).

The slow learners, on the other hand, had the following characteristic learning style traits: they preferred tactile or kinestnetic perceptual modes (Carbo, 1983, b) (R. Dunn, 1979) (Okabayashi and Torrance) (Price, Dunn, and Sanders); they preferred an informal design when concentrating (Dunn and Dunn, 1978) (Price, Dunn, and Sanders) (Shea); they were less persistent and responsible (Dunn and Dunn, 1978) (White); they preferred a large group which is teacher directed over small group approach (Peterson) (Price, Dunn, and Sanders); they tended to be aroused more by the right hemisphere instruction strategies (Carbo, 1983, b) (Okabayashi and Torrance), and Stellern, et. al. found that right brained students tended to be greater behavior problems through acting out, distractibility or withdrawing; they preferred learning in the late morning and preferred bright light but did not require much mobility (Price, Dunn, Sanders); and their cognitive style tended to be field dependent (Shade). Bolocofsky found that special

education students, who were found to be primarily field dependent, responded well to competition.

Only three of the articles were critical of the learning style paradigm. Davidman made apparently invalid criticisms of the work of Dunn, Dunn, Price, and Hunt because in another article in the same issue as Davidman's Dunn, Dunn, and Price defended the validity of their work correspondingly point by point using verifiable statistical research data and concluded by challenging Davidman to do a better job on his homework. (1981: 646) However, Davidman made one seemingly valid point for beginners when he cautioned educators to go slowly: "It is possible to work with a new concept like learning style while still adhering to the older planning tradition that relies on student needs as determined by teachers' opinions to formulate ...strategies." (Davidman: 642) Doyle and Rutherford raised several practical questions: how is it possible to accommodate the amount of diversity in one classroom and is there a possible system for administering and managing a large quantity of records and papers. (21) They also cited several reviews done on the literature on attribute treatment interactions which found few consistent results for programs matching instructional treatments to learning styles. (22) Finally, Hyman and Rosoff cited three issues that presented difficulties with the learning style paradigm: the concept is not clear even to the advocates, the focus on learning style in determining teaching action is inappropriate theoretically and realistically, and there are undesirable

consequences to students' self-concepts. (39)

However, the following researchers have investigated elements of learning style and have found that when students had a strong leaning in that element and were matched with complementary instruction, academic achievement improved (The level of significance is indicated when it was available in the studies): mobility or no mobility (Della Valle, .001); field dependence/global or field independence/analytical (Brennan) (Charlton) (Douglass, .01) (Mesoff) (Onyejiaku) (Saracho) (Shade) (Tannenbaum); bright or dim illumination (Krimsky); right or left brain (Banville) (Dunn, Cavanaugh, et. al.) (Levy) (Markman) (Okabayashi) (Reynolds and Torrance) (Stellern, et. al) (Zenhausern); high or low noise (Pizzo, .01); introversion or extroversion (Schmeck and Lockhart); formal or informal design (Shea, .001); social climate (DeYoung, .01); small or large groups (McLeod and Adams)(Peterson); high or low competition (Bolocofsky); preferred sensory modes (Carbo 1983 a, b, 1984) (Reinert); teacher's learning style (Cafferty) (Hunt and Gow) (Kuckinskas); and time of day (Dunn, Dunn, and Freeley). The preponderance of evidence seemed to support the learning style paradigm: when instruction was consonant with learning styles, academic achievement was increased.

CONCLUSTIONS

From the review of the literature the approach of matching instruction to learning style appeared to be the most successful course of action for improving academic achievement. Conversely, several researchers found that changing learning style to match instruction could also be beneficial. Reynolds and Torrance tested groups of subjects and believed they proved that it was not only possible to modify an individual's preferred style of learning and thinking over a relatively brief time period (six to twelve weeks), but that they could control the general direction of the change. Of the two sample groups they tested, the one selected for indirect training was comprised of high school honor students, and the group selected for direct training was a group of graduate students. These two sample groups, however, were not representative of student types having learning difficulty in a school situation where it would be desirous to try to change their learning style in order to accommodate an instructional strategy or environment. Reynolds and Torrance took students who were and already had achieved in the regular system. It could also be expected from the research that these students (honors students and graduate students) were strong perceptually and could learn in any perceptual mode.(Griggs) If the purpose was to improve academic achievement, Reynolds and Torrance have not proven by using these two unrepresentative sample groups that changing the learning style of a student having trouble learning in a regular classroom to accommodate the in-

structional method will increase achievement. However, if the learning style preference is merely a leaning and not a strong preference and if by changing it would accommodate better learning in a particular subject matter as Copenhaver suggested with English and math needing different kinds of thinking, then a proposed change could be warranted. But if the learning style is a strong preference, then trying to change it could be harmful. The preponderance of the evidence supports matching instruction and environment to the student's learning style.

A critical analysis of individualizing teaching styles to match learning styles raised the practical problem of devising a system for administering a large quantity of records and papers and managing multiple formats inherent with a complex classroom setting. (Doyle and Rutherford: 21) Although this problem could be handled efficiently enough in an elementary classroom where one teacher would be teaching the same twenty to thirty students throughout the day, at the secondary levels where one teacher could encounter 150 to 180 students per day, the amount of paperwork would be incomprehensible. At a learning styles seminar sponsored by the Oaklawn Center of Elkhart, Indiana, on February 19, 1985, Rita Dunn explained an alternative of how to use different strategies in teaching the same objective to a whole class of thirty students. The class remained teacher-directed; the teacher knew which students were auditory, visual, tactile, or kinesthetic learners and which had other strong leanings in other

learning preference stimuli. She demonstrated how it was possible to teach the same objective to all students in the classroom in the same lesson by introducing the objective to each student in his or her modality strength first and then reinforcing it with the secondary or tertiary strength. Combining such a teaching method with complementary homework strategies (Dunn, 1984, a) allowed the teacher to still direct the class while at the same time meet the individual learning styles of his/her students. This method would also appease the concern Davidman voiced for incorporating learning style into the traditional classroom by starting small and cautiously. (642)

Doyle and Rutherford's citings which found few consistent results for matching instructional programs to learning styles did not agree with the preponderance of evidence in this review of the literature. However, the researchers all agreed that much more research must yet be conducted on the learning style paradigm.

Although the preponderance of evidence supports the learning style paradigm, it must be noted that much of the research evidence was done by, with, or under the tutelage of one mentor, Rita Dunn, professor at St. John's University. Granting that a self-fulfilling prophecy could be in effect here, enough other researchers corroborated her work that learning style appears to be a viable teaching model to improve academic success in our schools. In fact, the National Association of Secondary School Principals must be convinced of learning style's potential impact since it cosponsors a national Learning Styles Network

with St. John's Center for the Study of Learning and Teaching Styles. The Network functions as a central clearinghouse and collection agency to meet the need for keeping research activity and practical application of student learning style in school settings. One outgrowth of the Network is a tri-annual publication of the Learning Styles Network Newsletter. It provides summaries of the latest research, practical applications, and experimental programs. It also keeps its subscribers informed about conferences, institutes, and in-service workshops for teachers and administrators. It describes publications and dissertations in the field, identifies sources, personnel and exemplary school sites; lists updated bibliographies of publications and films; and responds to written or telephone requests for information. The research is documented, and the Network itemizes the results of selected investigations verifying the statistically significant achievement that results when students are taught through preferred learning styles. (Dunn, 1985: 33) Learning styles has become a "state of the science." (Dunn, 1984, b: 10)

Cafferty summed up the need to match learning styles to instructional strategies when she quoted educators and researchers on cognitive learning style, Joseph Hill and Derek Nunny. "We believe that 90 percent of the students with normal ability can learn 90 percent of the material 90 percent of the time if teaching methods and media are adjusted to the student's educational cognitive style." (106-107) Heikkinen, et. al. underscored the crux of the issue:

there must be a "broader understanding of individual learning styles or preferred conditions for learning. The importance of pluralistic approach to teaching cannot be overstated if maximizing the learning process is to be a major goal of teacher education." (85)

RECOMMENDATIONS

Upon completion of this review of the literature, it is recommended that:

1. Teacher training institutions train and equip education majors to exhibit a variety of instructional modalities that can reach all four perceptual senses: kinesthetic and tactile as well as auditory and visual. In addition, the teacher training institutions train teacher candidates to diagnose and appropriately prescribe to individual differences in styles of learning.

2. For teachers already in the field, school systems provide inservice training to teach teachers the variety of instructional strategies needed to accommodate the individual differences in the learning styles of their students. In addition, the school systems train their teaching staff members how to diagnose and appropriately prescribe to individual differences in styles of learning.

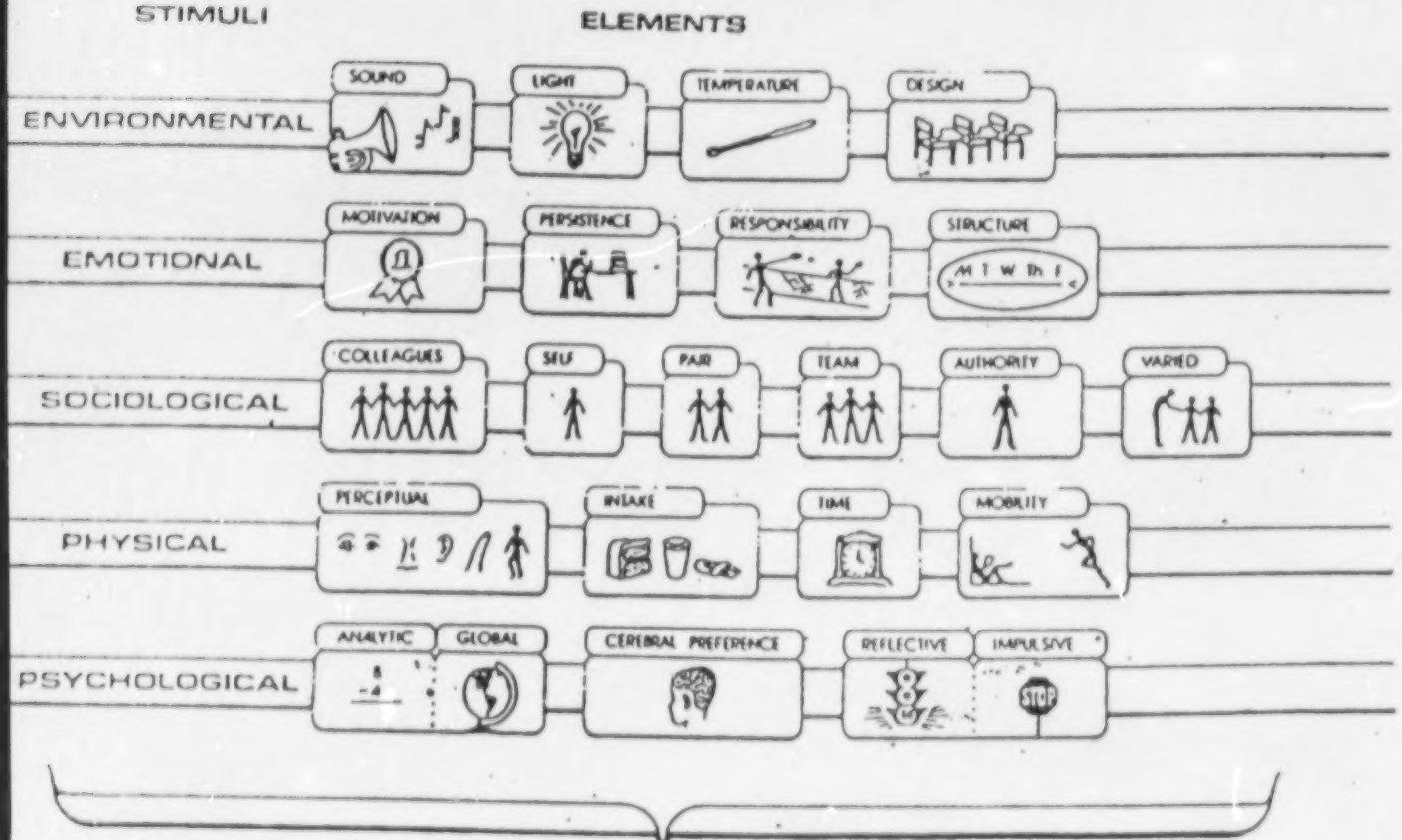
3. School boards allocate the funding necessary for diagnostic testing for learning styles and needed staff inservice programs.

4. Textbook publishers design reading programs that accommodate the learning style of all youngsters, with particular attention paid to the needs of those exhibiting the learning style profile of the poor reader.

5. Teachers, rather then jumping into a full-fledge individualized learning styles program initially, start small by trying to match instruction to their slow learners first or trying a new strategy as he/she becomes competent in teaching and matching it to an appropriate style need and then keep adding to his/her repertoire as he/she learns a variety of teaching strategies that are consonant with the variety of learning style needs of the students.

6. Researchers continue to investigate the results of matching instruction and environment to individual learning styles.

DIAGNOSING LEARNING STYLES



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